FIG_1

A - A section

FIG_2

B - B section

C - C section

Composite

(54) PNEUMATIC TIRE

(57) In a pneumatic tire having a tread pattern of blocks defined by circumferential grooves extending along a rotating direction of the tire and lateral grooves extending along a widthwise direction of the tire and provided in the block with at least a pair of one-side opened sipes alternately opening at their ends to opposed circumferential grooves along substantially the widthwise direction of the tire and having a depth different from a depth of the lateral groove, rubber flowing delays between mutual blades for the formation of the tire disposed in a mold during the vulcanization building of the tire to drag surface layer of rubber and hence creasing is caused to result in flow crack. In the invention, the one-side sipes formed in the block satisfy a relationship between cross sipe depth (D) and sipe interval ratio (a/w) of $D \leq (a/w \times 50) - 18$.

EP 0 911 187 A1

Description

TECHNICAL FIELD

[0001]   This invention relates to a pneumatic tire having blocks defined by circumferential grooves formed along a rotating direction of the tire and lateral grooves formed along a widthwise direction of the tire and provided with one-side opened sipes opening to the circumferential grooves in opposite directions to each other, and more particularly it is to avoid dragging of surface rubber or so-called creasing due to delay of rubber flow in the vulcanization building of the tire to prevent the occurrence of flow crack resulted from the creasing.

BACKGROUND ART

[0002]   In the pneumatic tire having a tread pattern provided with the blocks, it is general to have a structure that a plurality of sipes are formed in the block, which particularly ensures the gripping force on wet road surface and snow-ice road surface as a function thereof.

[0003]   In order to ensure such a function up to a last running stage of the tire, it is usually attempted to make the depth of the sipe deeper. However, as the cut depth of the sipe approaches to the depth of the groove formed along the same direction as the sipe, strain produced in the bottom of the sipe becomes large in the running to cause a trouble of chipping the block.

[0004]   As a countermeasure for preventing such a chipping of the block, it has hitherto been attempted to arrange at least a pair of sipes extending substantially in parallel to the lateral grooves in the widthwise direction of the tire in each of the blocks in which one end of each of the sipes is alternately opened to one of the opposed circumferential grooves ad the depth of the sipe is made deeper than that of the lateral groove. In this case, however, the flowing of rubber delays between mutual blades for the formation of the sipe disposed in a vulcanization mold in the vulcanization building of the tire and hence the creasing of dragging a surface layer of rubber can not be avoided to cause a problem of creating flow crack.

[0005]   It is an object of the invention to provide a novel pneumatic tire capable of solving the aforementioned drawbacks of the conventional technique.

DISCLOSURE OF INVENTION

[0006]   The invention lies in a pneumatic tire having a tread pattern of blocks defined by circumferential grooves extending along a rotating direction of the tire and lateral grooves extending along a widthwise direction of the tire and provided in the block with at least a pair of one-side opened sipes alternately opening at their ends to opposed circumferential grooves along substantially the widthwise direction of the tire and having a depth different from a depth of the lateral groove,

characterized in that the one-side opened sipe satisfies a relationship between cross sipe depth (D) and sipe interval ratio (a/w) represented by $D \leq (a/w \times 50)-18$. Particularly, an overlap length L between the sipes in the block is not less than 10 mm.

[0007]   In the pneumatic tire having the above construction according to the invention, when the cross sipe depth (D) is not more than 3 mm, the one-side opened sipes satisfy conditions of $0.42 \leq a/w_1 < 1.0$ and $0.42 \leq a/w_2 < 1.0$ when a shortest distance between the sipes at the bottom portion of the sipe is a and distances from an edge of the block not opened by the sipe to one of the one-side opened sipes farthest from the edge of the block is w_1 or w_2.

[0008]   The term "sipe interval ratio" used herein is defined by a ratio of shortest distance a between mutual sipes at the bottom of the one-side opened sipe at A-A section of the block to distance w in parallel thereto and existing from an edge of the block not opened by the sipe to one of the one-side opened sipes farthest from the edge of the block as diagrammatically shown in Fig. 1 (provided that when $w_1 \neq w_2$, a smaller value in either of both is adopted).

[0009]   And also, the term "cross sipe depth" used herein is defined by a distance D between a deepest position of apparently crossing adjoining sipes S_1, S_2 in a single block b with each other taken from a side view of the block and a position of apparently intersecting a line segment n passing through the deepest position and perpendicular to the surface of the block b with a groove bottom of the lateral grooves sandwiching the block b taken from the side view of the block as shown in Fig. 2 conveniently composing B-B section and C-C section of Fig. 1 (full range r in the embodiment of Fig. 2 has a distance D).

[0010]   Moreover, the shortest distance a between the sipes is a straight distance between mutual flask portions in case of a flask type sipe and a straight distance between mutual pin portions in case of a pin type sipe.

[0011]   In the invention, it is favorable that a straight distance from the edge of the block not opened by the sipe to a sipe nearest to the block edge is 20-40% of a length of the block along the block edge, preferably about 30%.

[0012]   And also, flask type sipe or one-side flask type sipe is advantageously adapted as the sipe from a viewpoint of mitigating strain to the bottom of the sipe in the running of the tire.

[0013]   Furthermore, in the invention, the sipe is provided with a slant portion connecting a cut end of the sipe to a bottom portion of the sipe therebetween.

[0014]   When the sipes are formed in the block in the vulcanization building of the tire, there is used a vulcanization mold provided in its inside with blades for the formation of the sipe. However, if it is intended to form a pair of one-side opened sipes S_1, S_2 extending substantially in parallel to the widthwise direction of the tire and alternately opening at their ends to the opposed cir-

cumferential grooves k as shown in Fig. 3, smooth flowing of robber is carried out in a position of a vulcanization mold M corresponding to a region A-A of Fig. 3 at both sides of a blade C disposed in the mold M as shown in Fig. 4(a), while the flowing of rubber between mutual blades C tends to in a position of the mold M corresponding to a region B-B of Fig. 3 as shown in Fig. 4(b) as compared with the flowing of rubber at the outside region of the blade C. As shown by arrows in Fig. 5, rubber flowing between mutual sipes S_1, S_2 creates a time difference from right and left side portions of these sipes shown in this figure to drag a surface layer of robber as shown in Fig. 6 and hence flow crack d as shown in Fig. 7 is created in a central portion of section including both the sipes S_1, S_2. This crack d results in the block loss b under an action of external force applied in the running of the tire.

[0015]   In the invention, the sipes S_1, S_2 have a depth deeper than a groove depth of the lateral groove formed in the widthwise direction of the tire and satisfy the relationship between cross sipe depth D and sipe interval ratio a/w represented by $D \leq (a/w \times 50) - 18$, so that the rubber flowing between mutual blades C disposed in the vulcanization mold M can be made approximately equal to that of the other zone and hence the occurrence of the creasing is avoided.

[0016]   In the invention, the overlap length between mutual adjoining sipes S_1, S_2 in a plan view is a size L shown in Fig. 8. This value is not less than 10 mm for completely preventing the occurrence of the creasing irrespectively of the production conditions and rubber material.

[0017]   Fig. 9 shows results examined on the relationship between the cross sipe depth D and the sipe interval ratio a/w with respect to the occurrence of the creasing when the overlap length L between the sipes S_1, S_2 (tread pattern shown in Fig. 19, sipe shown in Fig. 13) is not less than 10 mm.

[0018]   When the overlap length L between the sipes S_1, S_2 is not less than 10 mm, the occurrence of the creasing can completely be prevented when the above condition or $D \leq (a/w \times 50) - 18$ is satisfied.

[0019]   Fig. 10 shows a state of varying the creasing depth with respect to a/w (a/w_1, a/w_2) as a relation between the shortest distance a between mutual sipes at the bottom portion of the sipe and distance w_1, w_2 from the block edge to a sipe farthest therefrom in case of cross sipe depth D=3 mm (tread pattern shown in Fig. 19, sipe shown in Fig. 13). When w_1, w_2 satisfy $0.42 \leq a/w_1 < 1.0$ and $0.42 \leq a/w_2 < 1.0$, it is clear that there is observed no occurrence of the creasing. Similarly, in case of $D \leq 3$ mm as shown in a graph of Fig. 9, when the above condition is satisfied, no occurrence of the creasing is observed.

[0020]   And also, straight distances L_1, L_2 from edges e of the block not opened by the sipe to sipes S_1, S_2 nearest thereto as shown in Fig. 8 are favorable to be 20-40%, preferably about 30% of a side length m of the block opened by the sipe from a viewpoint of the guarantee of the block rigidity.

[0021]   Figs. 11(a) and (b) show a sectional shape of a sipe at its bottom portion, respectively. In the invention, a flask type sipe as shown in Fig. 11(a) or a one-side flask type sipe (one-side pin flask) as shown in Fig. 11(b) is advantageously adaptable. Thus, the distance a between the mutual sipes can be made somewhat longer than that of a pin flask type sipe as shown at A-A section in Fig. 1 to increase the sipe interval ratio, which is more advantageous in the prevention of the creasing. Furthermore, not only the drainage performance is stably maintained but also the edge effect cutting water film can be expected even in the last running stage of the tire (last wearing stage), so that the high gripping force in wet road surface and ice-snow road surface can be ensured.

[0022]   Moreover, according to the invention, the opening directions of the sipes can alternately be opposed every the adjoining blocks along the forward rotating direction of the tire, whereby the block rigidity can be enhanced. And also, the sipes as defined in the invention may be formed in a block row existing in a shoulder portion.

[0023]   Although the sipe to be formed in the block is straight in the illustrated embodiments of the invention, it may be zigzag. Even in the latter sipe, the effect of preventing the occurrence of the creasing resulted in the flow crack is unchangeable.

[0024]   In Fig. 12 is shown a main part of a pneumatic tire having the sipe structure according to the invention. Fig. 13 is B-B section and C-C section of sipes S_1, S_2 shown in Fig. 12 together with a side view conveniently composed them at the C-C section.

[0025]   Particularly, in order to prevent uneven wear of the block, this tread pattern has a construction that a step difference t is formed so as to change the groove depth of the lateral groove at both sides of the step difference to increase the rigidity of the block b opened by the sipe at its kicking-out side b_K (the kicking-out side of the block easily opens the sipe and the groove depth of the lateral groove corresponding to such a side is shallowed to increase the rigidity and the subsequent groove depth of the lateral groove bordered by the step difference t is deepened to take a balance to the shallowed portion) and also the depth of the sipe is changed along the lateral groove (a slant portion S_K is formed) to prevent the chipping of the block. In this embodiment, the cross sipe depth D is a distance between a deepest position h of apparently crossing the sipes S1, S2 taken in a side view and a position i of apparently intersecting a line segment n passing through the position h and perpendicular to the outer surface of the block with groove bottoms of the lateral grooves sandwiching the block b therebetween as shown in Fig. 13.

[0026]   As shown in Fig. 13, the slant portion SK is formed between a cut edge S_a of the sipe S_1, S_2 and the bottom portion thereof to connect them, whereby the

block chipping can be prevented and also it is possible to make the value of the cross sipe depth D smaller than that of the sipe having a flat bottom portion as shown in Fig. 2 (called as a flat sipe), which can advantageously enlarge the no-creasing zone shown in a relation to the sipe interval ratio in Fig. 9. Furthermore, such a sipe tends to smoothen the flowing of robber at an initial stage in the vulcanization building of the tire.

[0027] The shape of the slant portion SK may be straight or curved. And also, the forming zone of the slant portion may be a region directly ranging from a cut end of the sipe along the bottom portion to an opening end of the sipe.

[0028] In Figs. 14-17 are shown main parts of a blade C for the formation of the sipe and a projection j for the formation of the circumferential groove disposed in an inside of a mold M suitable for the manufacture of the pneumatic tire according to the invention, respectively. Particularly, when the sipe is a flask type sipe (pin flask, flask, one-side flask or the like), an expanding portion C_1 capable of forming the flask is disposed on a top end portion of the blade C.

[0029] Fig. 18 shows an example that the depth of the sipe S_1, S_2 is shallower than that of the lateral groove, which is included in the invention. In this case, the cross sipe depth D is conveniently adopted to be zero.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

Fig. 1 is a plan view and A-A section of a pneumatic tire according to the invention.
Fig. 2 is B-B section, C-C section and a composed side view of Fig. 1.
Fig. 3 is a view illustrating a main part of a tread in the pneumatic tire.
Fig. 4 is a diagrammatic view of a mold for the vulcanization building of the tire and rubber flowing in the mold, in which (a) is a portion corresponding to A-A region of Fig. 3 and (b) is a portion corresponding to B-B region of Fig. 3.
Fig. 5 is a view illustrating the flowing state of rubber in the conventional vulcanization building.
Fig. 6 is a view illustrating a creasing state.
Fig. 7 is a view illustrating a flow crack.
Fig. 8 is a schematic view of an overlap length L.
Fig. 9 is a graph showing a relationship between cross sipe depth and sipe interval ratio.
Fig. 10 is a graph showing a relation between a/w and a creasing depth.
Figs. 11(a) and (b) are views illustrating sectional shapes of the sipe according to the invention.
Fig. 12 is a view of a tread pattern in the pneumatic tire according to the invention and its A-A section.
Fig. 13 is a sectional shape and composed side view of sipes in the pneumatic tire according to the invention.

Fig. 14 is a view illustrating a main part of an inside of a vulcanization building mold suitable for the manufacture of the pneumatic tire according to the invention.
Fig. 15 is a view illustrating a main part of an inside of the vulcanisation building mold suitable for the manufacture of the pneumatic tire according to the invention making a pair with that shown in Fig. 14.
Fig. 16 is a view illustrating a main part of an inside of another vulcanization building mold suitable for the manufacture of the pneumatic tire according to the invention.
Fig. 17 is a view illustrating a main part of an inside of the vulcanization building mold suitable for the manufacture of the pneumatic tire according to the invention making a pair with that shown in Fig. 16.
Fig. 18 is a view showing a main part of a tread pattern in the pneumatic tire according to the invention and its section.
Fig. 19 is a view illustrating a tread pattern in the pneumatic tire according to the invention.
Fig. 20 is a section and a composed side view of sipes in the tire shown in Fig. 19.
Fig. 21 is a view illustrating a tread pattern in the pneumatic tire according to the invention.
Fig. 22 is a view illustrating a tread pattern in the pneumatic tire according to the invention.
Fig. 23 is a section and a composed side view of sipes in the pneumatic tires shown in Fig. 21 and Fig. 22.
Fig. 24 is a view illustrating a tread pattern in the pneumatic tire according to the invention.
Fig. 25 is a sectional shape and a size of sipes in the tire shown in Fig. 24.
Fig. 26 is a view illustrating a tread pattern in the pneumatic tire according to the invention.
Fig. 27 is a sectional shape and a size of sipes in the tire shown in Fig. 26.

BEST MODE FOR CARRYING OUT THE INVENTION

[0031] Fig. 19 shows a tread pattern applied to a pneumatic tire (a heavy duty pneumatic tire having a size of 11R22.5) with a sipe structure according to the invention having sipes as shown in Fig. 2 (flat sipes). In this embodiment each of blocks b_1, b_2 existing in a central zone 1 and both side zones 2 of a tread (size of block: 28.5 mm in a rotating direction, 37.5 mm in a widthwise direction) is provided with two straight sipes S_1, S_2 extending along an edge of the block in the widthwise direction (pin flask type, overlap length L= 22.5 mm, straight distance from an edge of the block not opened by the sipe to a sipe nearest thereto = 9.5 mm, w_1=w_2= 18 mm, length from a cut end to opening end = 30 mm), a straight distance a between mutual sipes in each sipe S_1, S_2 is 8 mm (a/w_1, a/w_2=0.444), a groove depth of each sipe S_1, S_2 is 18 mm, a depth of a circumferential groove is 20 mm, a depth of a lateral groove is

12.5 mm, and a cross sipe depth D is 5.5 mm.

[0032] In the pneumatic tire having the above construction, it is possible to smoothen the robber flowing from a lower side of a blade in a mold during the vulcanization building and the occurrence of the creasing resulting in flow crack is not observed.

[0033] Fig. 20 shows an embodiment of the pneumatic tire having the same structure as in Fig. 19 except that a step difference t is formed in the lateral groove of the tire for increasing the rigidity of the block at a kicking-out side and groove depths at both sides of the step difference are 10 mm and 15 mm and the cross sipe depth D is 7 mm. Even in this pneumatic tire, it is possible to smoothen the robber flowing from a lower side of a blade in a mold during the vulcanization building and the occurrence of the creasing resulting in flow crack is not observed.

[0034] In Fig. 21 and Fig. 22 are shown another tread patterns of the pneumatic tire according to the invention (tire size: 11R22.5) having a step difference t in the lateral groove and sipes with a shape and a size as shown in Fig. 23, respectively. In these embodiments, a/w_1 and a/w_2 are 0.428, L is 12 mm, and the cross sipe depth D is mm. Even in the pneumatic tire having the above construction, the occurrence of the creasing is not observed.

[0035] In Fig. 24 is shown a pneumatic tire in which a cut length P in the central zone 1 of the tread is 20 mm, a is 8 mm, w_1 and w_2 are 24 mm, a/w_1 and a/w_2 are 0.333, L is 8 mm, sipes S1, S2 have a shape and a size as shown in Fig. 25 and the side zone 2 of the tread is the same as in Figs. 21 and 22. Even in this tire, the rubber flowing is smooth at a position corresponding to the blade of the mold in the vulcanization building and the occurrence of the creasing resulting in the flow crack is not observed.

[0036] In Fig. 26 is shown a tread pattern applied to a pneumatic tire having lateral grooves with a step difference t (heavy duty pneumatic tire having a size of 11R22.5).

[0037] In this embodiment, each of blocks b_1, b_2 existing in the central zone 1 and both side zones 2 of the tread (size of block: 22.6 mm in a rotating direction, 25.0 mm in a widthwise direction) is provided with two straight sipes S_1, S_2 extending along an edge of the block in the widthwise direction (pin flask type, overlap length L = 15 mm, straight distance from an edge of the block not opened by the sipe to a sipe nearest thereto = 7.5 mm, $w_1=w_2=$ 16 mm, straight distance a between mutual sipes = 6 mm, sipe interval ratio a/w_1, a/w_2 =0.375 mm), and a cross sipe depth D is 0 mm.

[0038] In such a pneumatic tire, the robber flowing is smooth from the lower portion of the blade of the mold in the vulcanization building, and the uneven wear can be improved without causing the creasing resulting in the flow crack.

INDUSTRIAL APPLICABILITY

[0039] According to the invention, the rubber flowing is smoothly conducted in the mold during the vulcanization building, so that there can be prevented the occurrence of the creasing, which has been come into problem in the manufacture of the pneumatic tire proved with at least a pair of one-side opened sipes alternately opening at their ends to opposed circumferential grooves.

Claims

1. A pneumatic tire having a tread pattern of blocks defined by circumferential grooves extending along a rotating direction of the tire and lateral grooves extending along a widthwise direction of the tire and provided in the block with at least a pair of one-side opened sipes alternately opening at their ends to opposed circumferential grooves along substantially the widthwise direction of the tire and having a depth different from a depth of the lateral groove, characterized in that the one-side opened sipe satisfies the following relationship between cross sipe depth (D) and sipe interval ratio (a/w).

   Account

   $$D \leq (a/w \times 50)\text{-}18$$

   D: a distance between a deepest position of apparently crossing adjoining sipes in a single block with each other taken from a side view of the block and a position of apparently intersecting a line segment passing through the deepest position and perpendicular to the surface of the block with a groove bottom of the lateral grooves sandwiching the block taken from the side view of the block

   a: a shortest distance between mutual sipes at the bottom of the one-side opened sipe

   w: a distance in parallel to a and existing from an edge of the block not opened by the sipe to one of the one-side opened sipes farthest from the edge of the block

2. A pneumatic tire according to claim 1, wherein an overlap length L between the sipes in the block is not less than 10 mm.

3. A pneumatic tire according to claim 2, wherein when the cross sipe depth (D) is not more than 3 mm, the one-side opened sipes satisfy the following conditions when a shortest distance between the sipes at the bottom portion of the sipe is a and distances from an edge of the block not opened by the sipe to one of the one-side opened sipes farthest from the edge of the block is w_1 or w_2.

   Account

$0.42 \leqq a/w_1 < 1.0$ and $0.42 \leqq a/w_2 < 1.0$

4. A pneumatic tire pneumatic fire according to claim 1, wherein a straight distance from the edge of the block not opened by the sipe to a sipe nearest to the block edge is 20-40% of a length of the block along the block edge.

5. A pneumatic tire according to claim 1, wherein the sipe is a flask type sipe.

6. A pneumatic tire according to claim 1, wherein the sipe is a one-side flask type sipe.

7. A pneumatic tire according to claim 1, wherein the sipe has a slant portion connecting a cut end of the sipe to a bottom portion of the sipe.

FIG.3

FIG.4

(a)

(b)

FIG.5

S_1

b

Rubber
flowing

S_2

FIG.6

b

FIG.7

b

d

FIG.8

FIG.9

Creasing depth	
No creasing	□
0.1mm~2.0mm	◆
2.1mm~5.0mm	▲
5.1mm~	✕

FIG. 10

Parameter	Abscissa a/W₁ and a/W₂	Ordinate Creasing depth (mm)
Number of data	309	
Minimum value	0.253	0.000
Maximum value	0.500	10.000
Average value	0.406	1.230
Standard deviation	0.049	2.077
Mutual coefficient	-0.7996	

FIG. 11

(a)

(b)

FIG_12

A - A section

FIG. 13

Composite
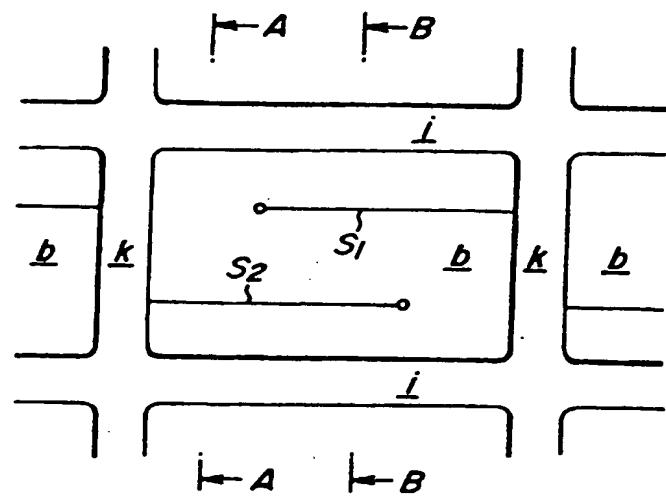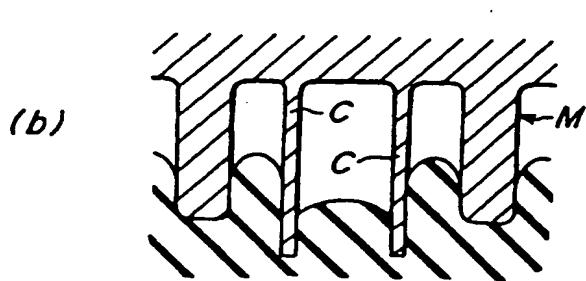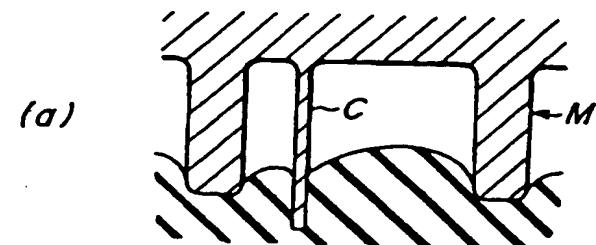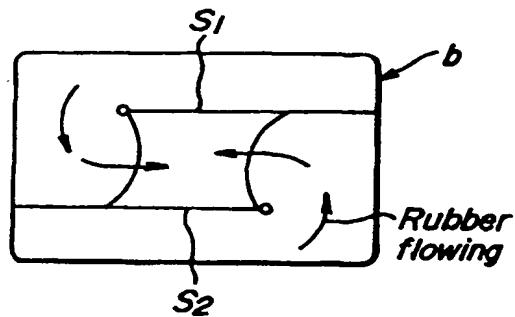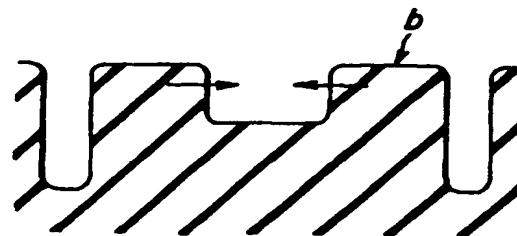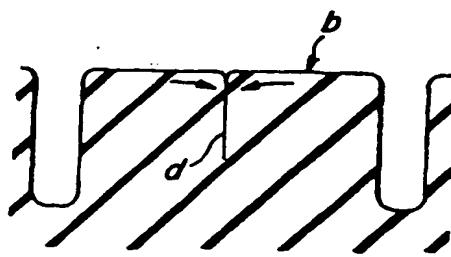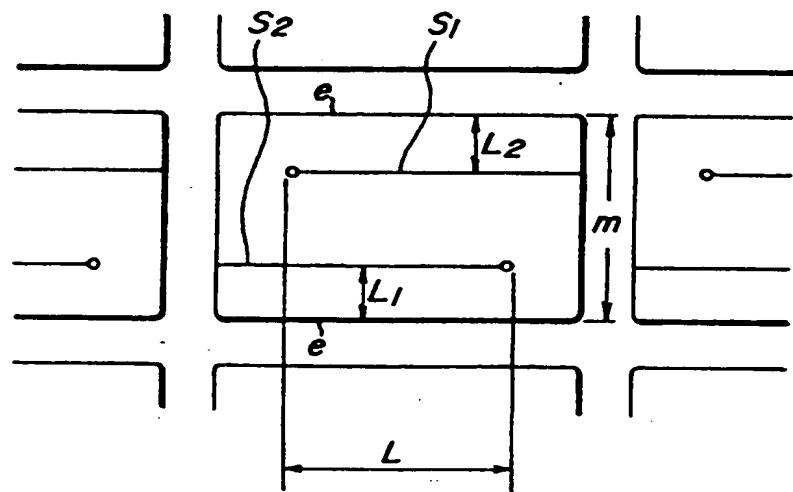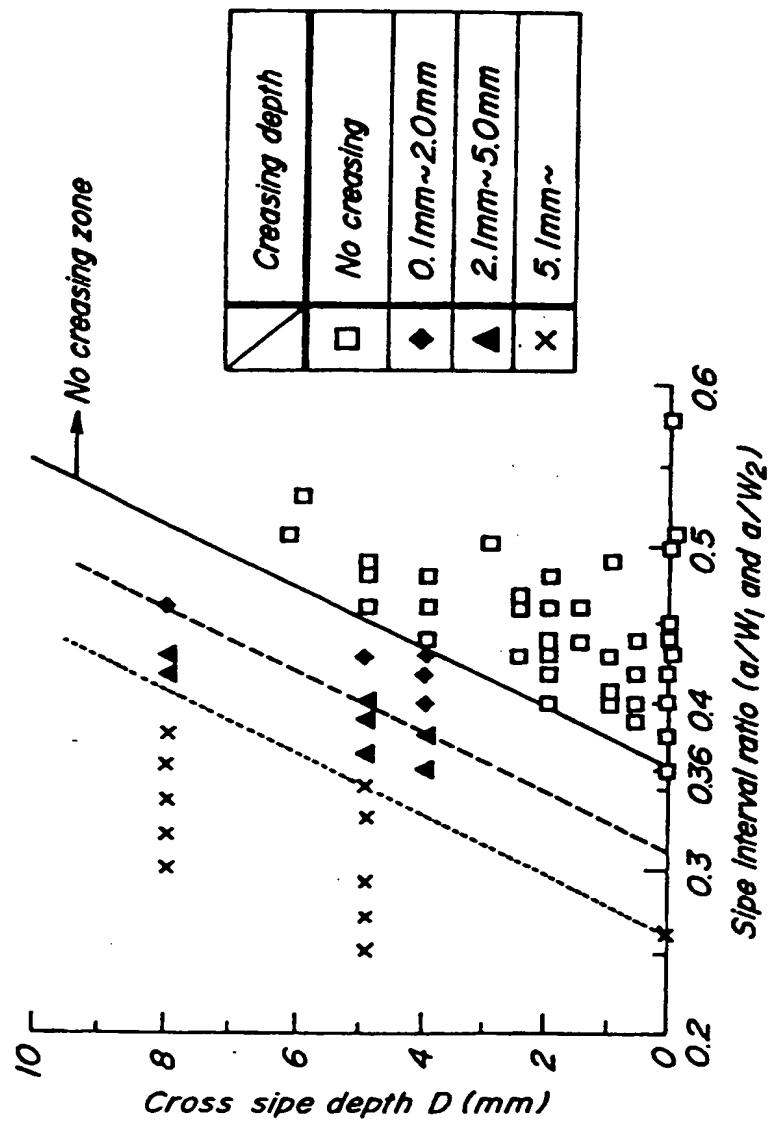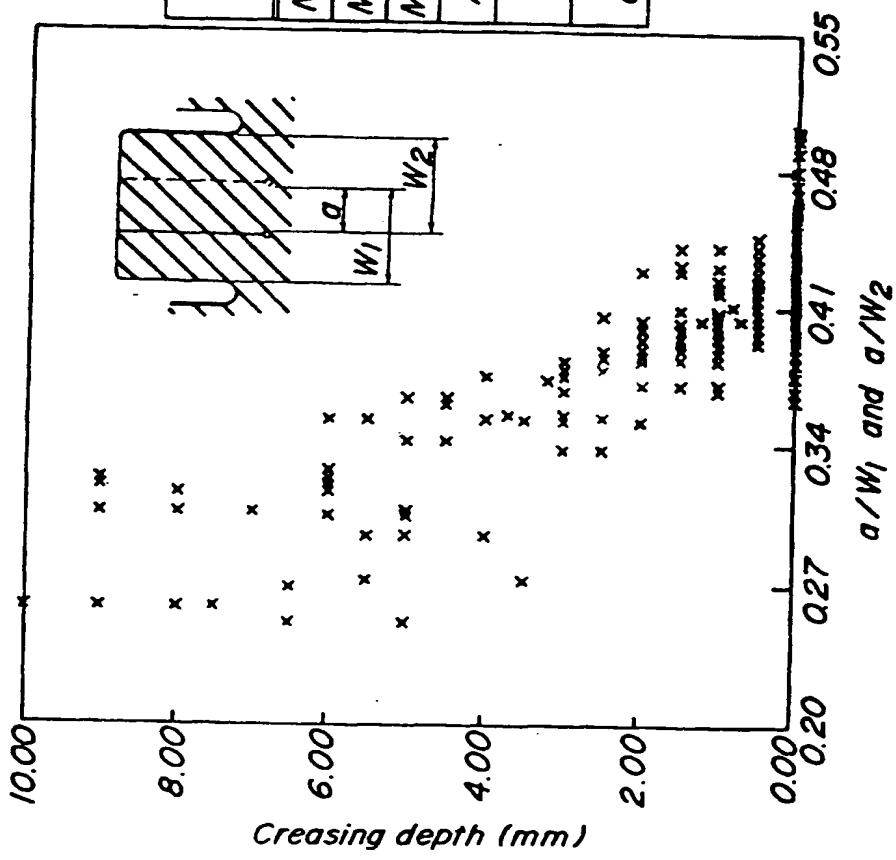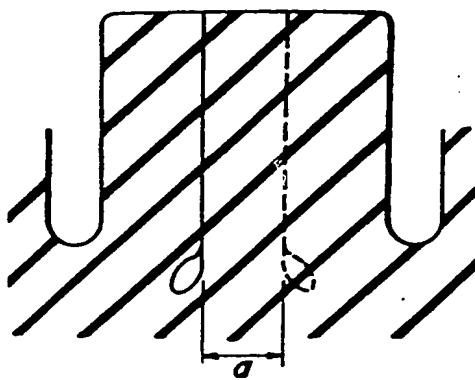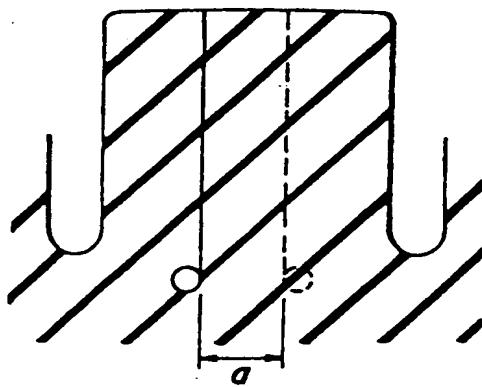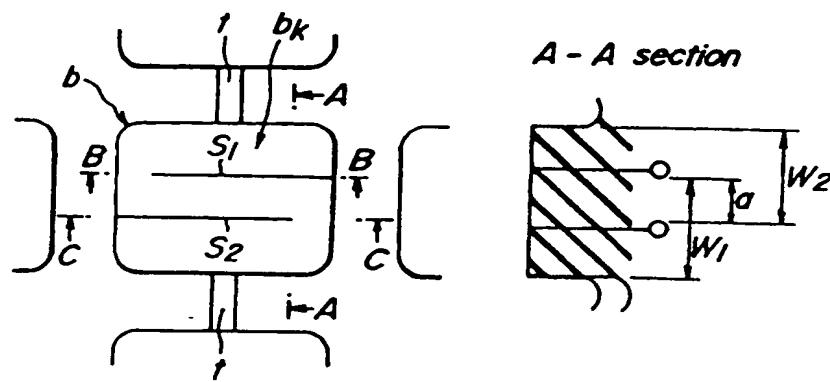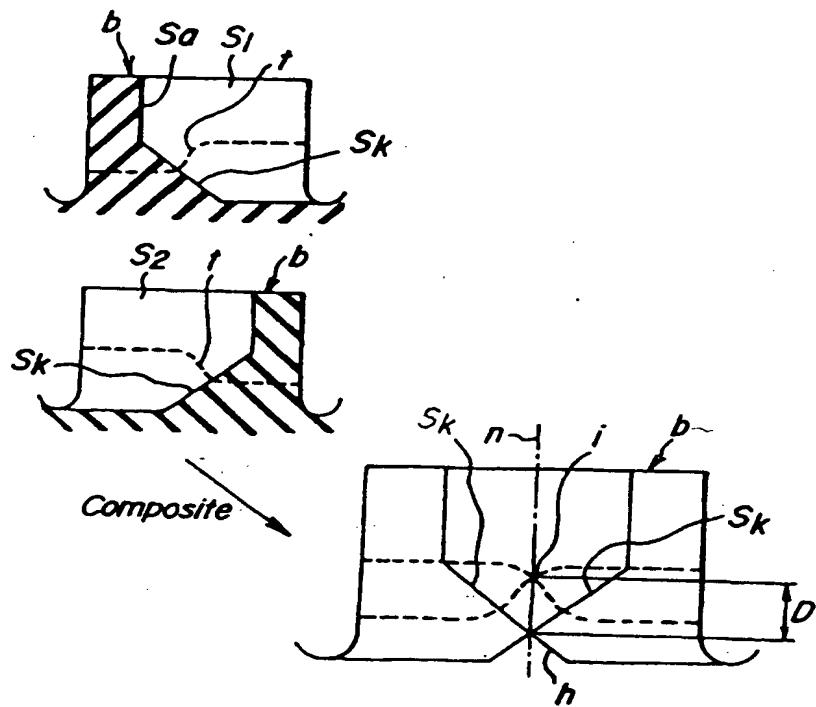
FIG_14
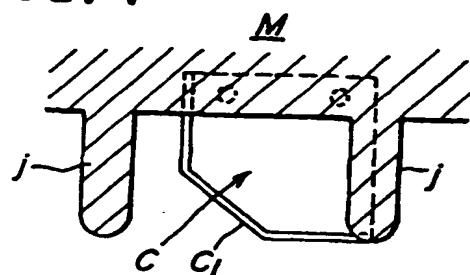
FIG_15

FIG_16

FIG_17

FIG_18

FIG.19

FIG. 20

Composite

FIG.21
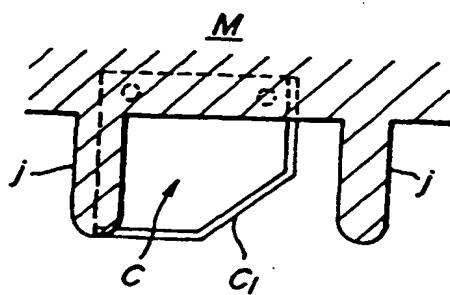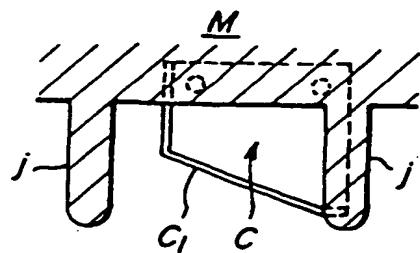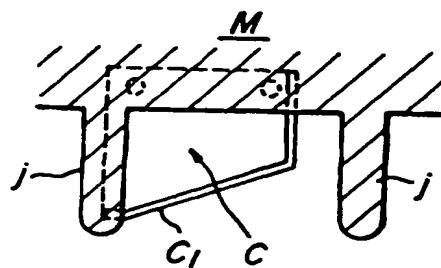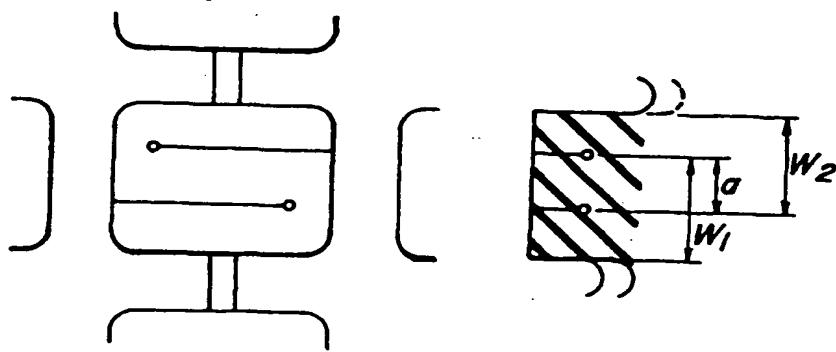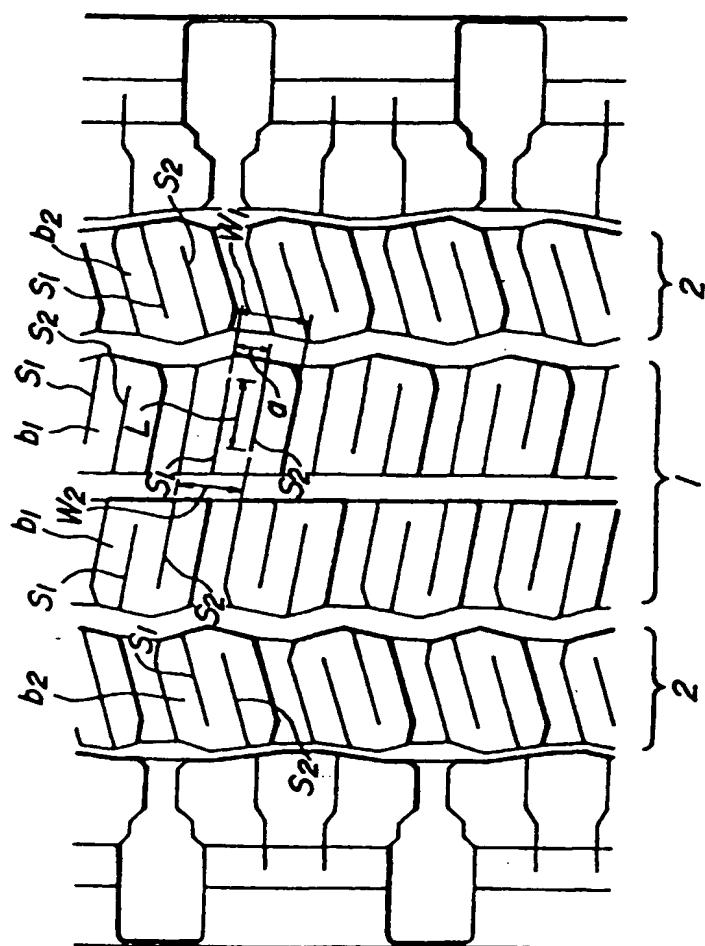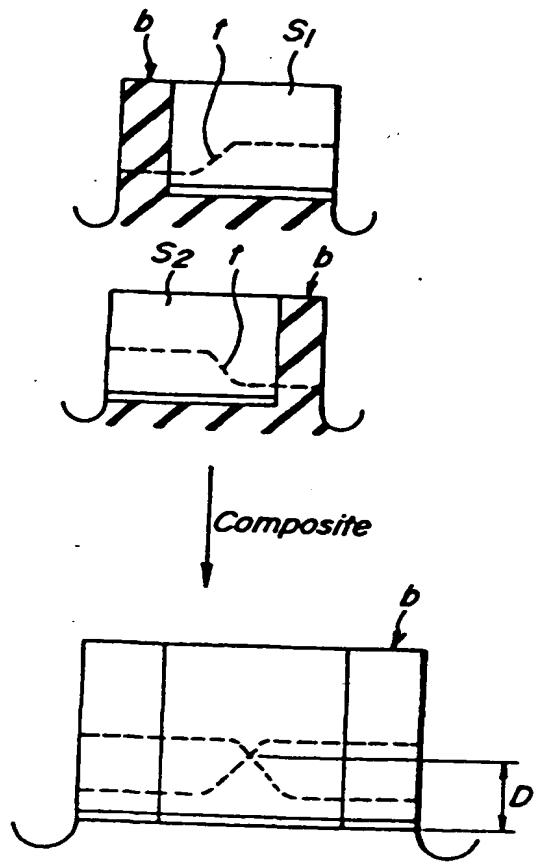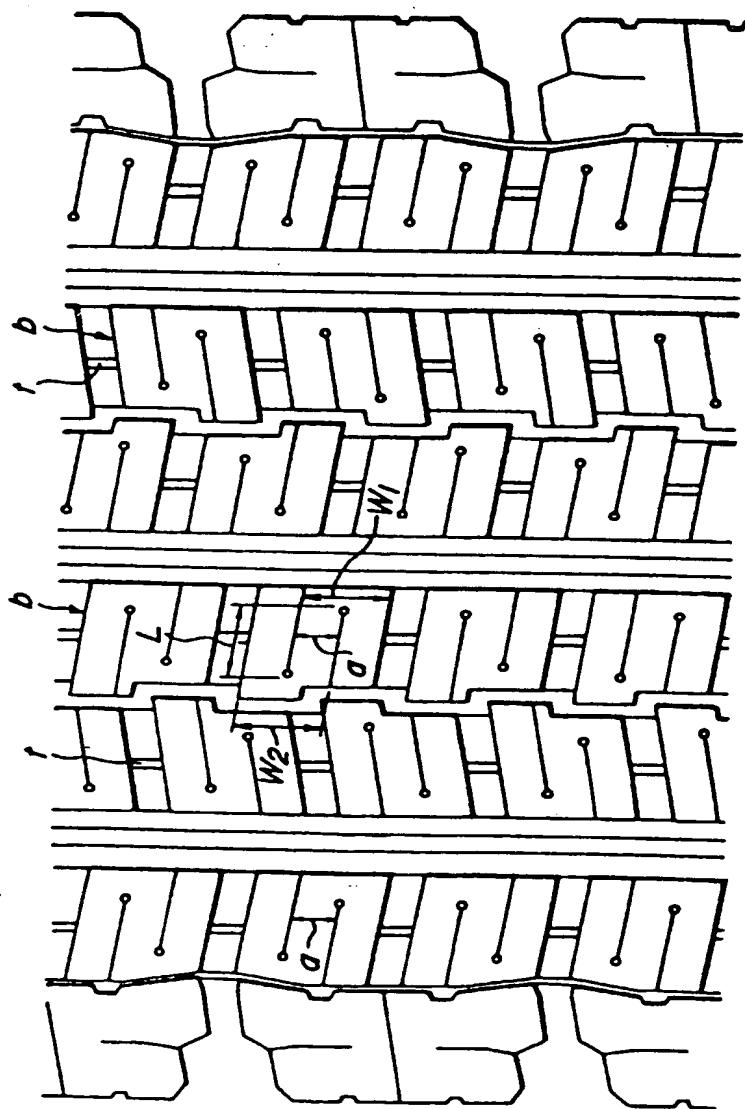
FIG.22
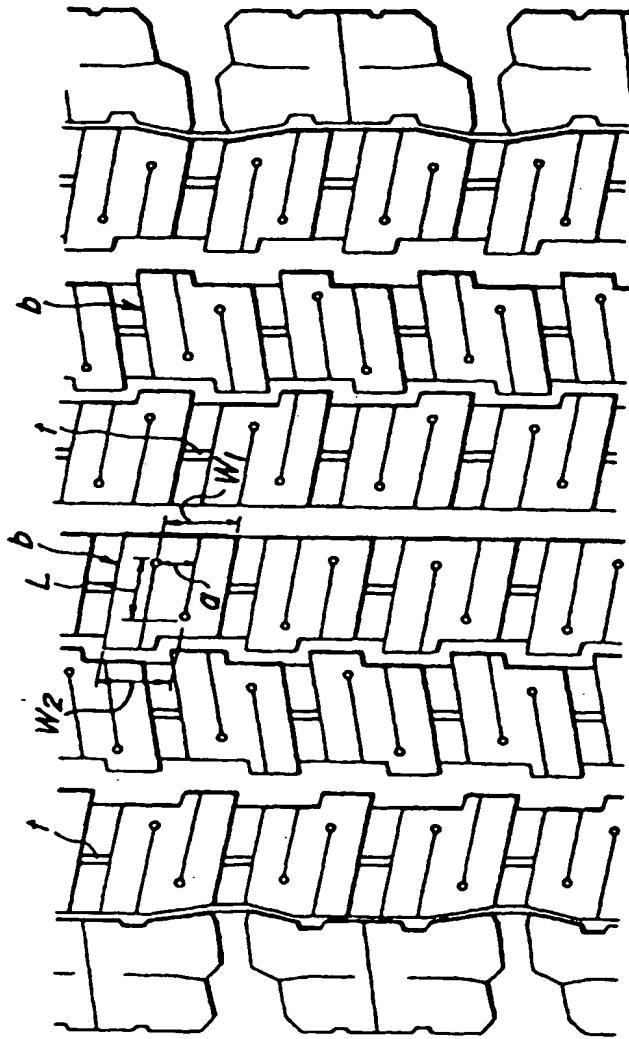
FIG_23
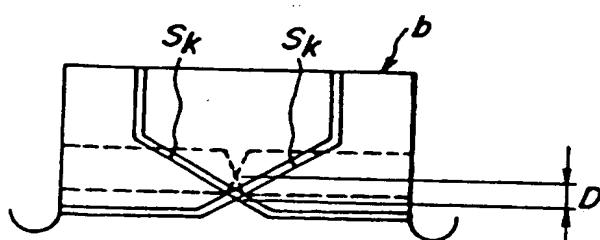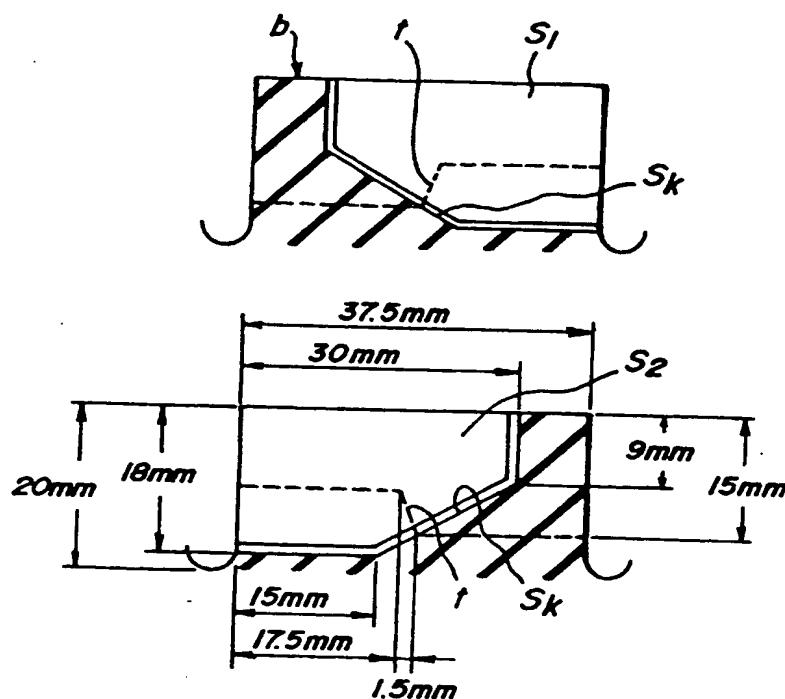
FIG.24

FIG. 25

FIG.26

FIG.27

Composite
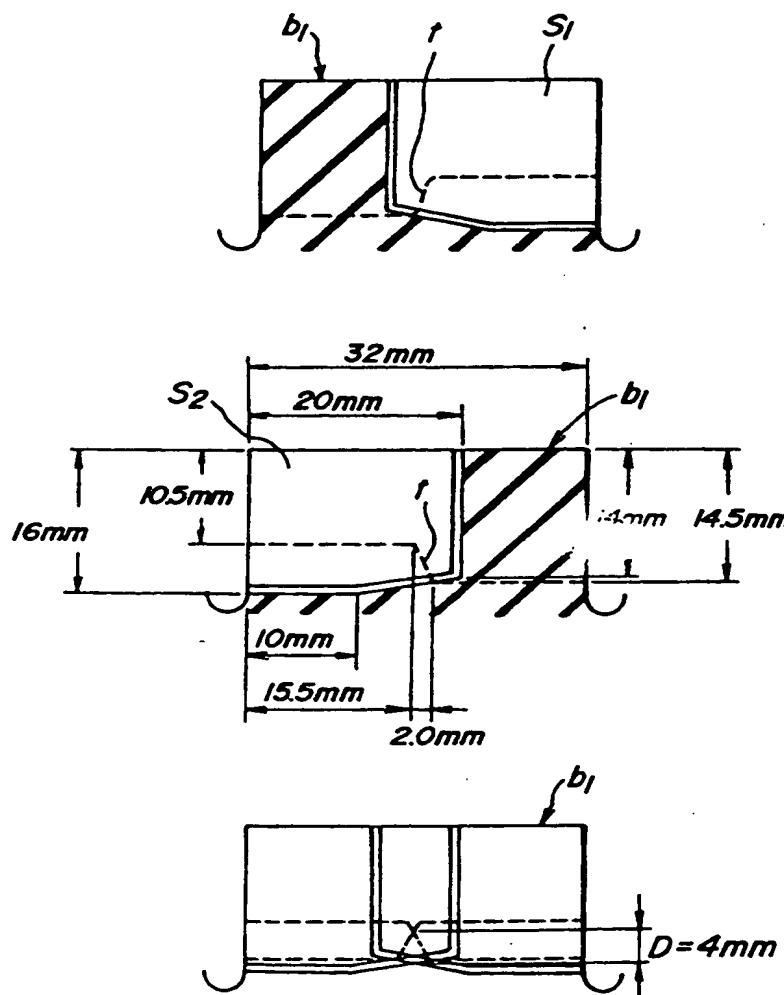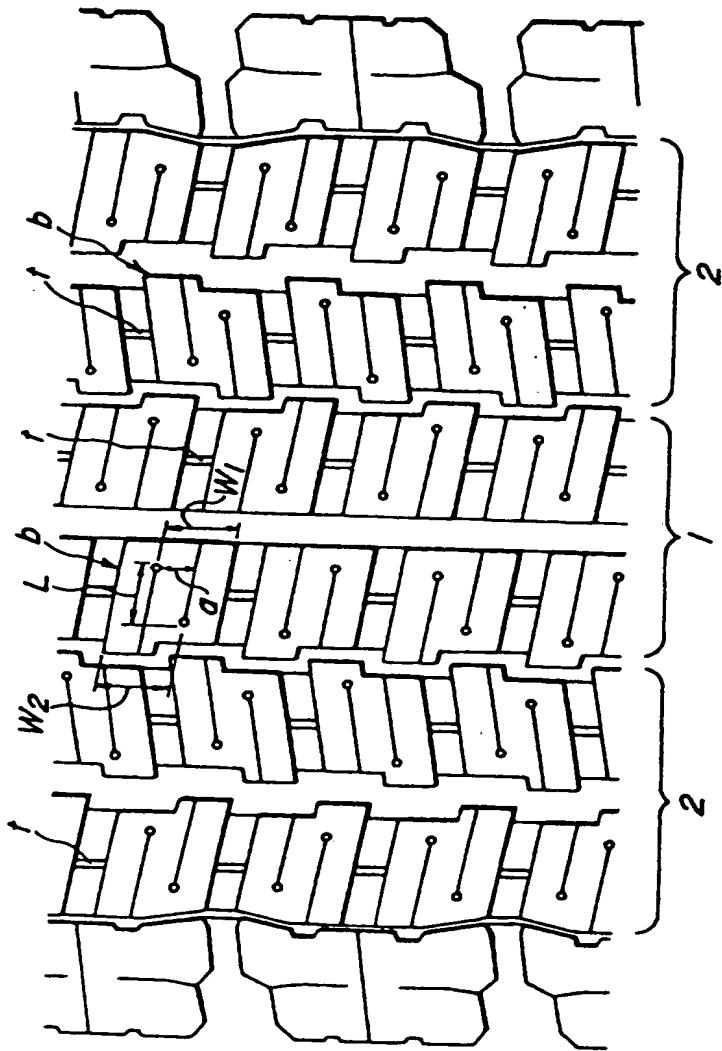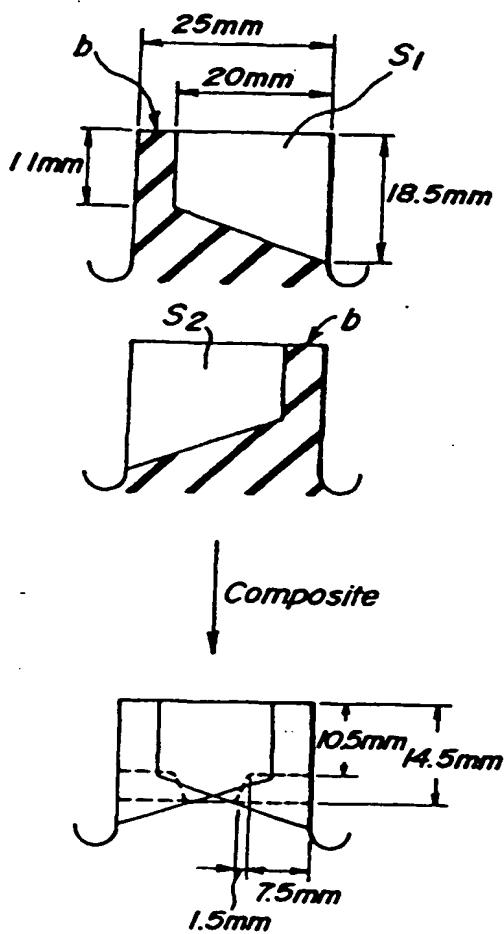
INTERNATIONAL SEARCH REPORT

| International application No. |
|---|
| PCT/JP98/00988 |

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl⁶ B60C11/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl⁶ B60C11/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho	1926-1996	Toroku Jitsuyo Shinan Koho	1994-1998
Kokai Jitsuyo Shinan Koho	1971-1995	Jitsuyo Shinan Toroku Koho	1996-1998

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PY	JP, 9-202115, A (Bridgestone Corp.), August 5, 1997 (05. 08. 97) (Family: none)	1-7
PY	JP, 9-156324, A (Bridgestone Corp.), June 17, 1997 (17. 06. 97) (Family: none)	1-7
Y	JP, 8-104112, A (Bridgestone Corp.), April 23, 1996 (23. 04. 96) & EP, 654366, A1	1-7
Y	JP, 7-186629, A (Sumitomo Rubber Industries, Ltd.), July 25, 1995 (25. 07. 95) (Family: none)	1-7
Y	JP, 7-172111, A (Bridgestone Corp.), July 11, 1995 (11. 07. 95) (Family: none)	5-6
Y	JP, 5-131812, A (Bridgestone Corp.), May 28, 1993 (28. 05. 93) & EP, 540339, A2 & UA, 5385189, A	5-6

[x] Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
April 10, 1998 (10. 04. 98)	April 21, 1998 (21. 04. 98)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

	International application No.
	PCT/JP98/00988

C (Continuation).   DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 2-200503, A (The Yokohama Rubber Co., Ltd.), August 8, 1990 (08. 08. 90) (Family: none)	1-7
PA	JP, 9-183303, A (Sumitomo Rubber Industries, Ltd.), July 15, 1997 (15. 07. 97) (Family: none)	1-7

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